



# ***Test and Evaluation Report for The Field Medical Surveillance System (FMSS)***

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***Technical Document No. 06-2B***

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Technical Document No. 06-2B was supported by the Office of Naval Research, Arlington, VA, under Work Unit No. 60330. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release; distribution is unlimited. Human subjects participated in this study after giving their free and informed consent. This research has been conducted in compliance with all applicable federal regulations governing the protection of human subjects in research.

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## 1.0 Executive Summary

### 1.1 Background

This report represents a test and evaluation (T&E) of the Field Medical Surveillance System (FMSS), a product of the Field Medical Technologies program of the Naval Health Research Center (NHRC).

### 1.2 Method

Several data sources were used to conduct this study, including:

- A usability survey of eight users experienced with medical software who filled out structured survey questions and provided comments
- A functionality survey that systematically tested 35 basic operational claims drawn from the FMSS user's manual
- Validation testing by three technical consultants who evaluated the 35 operations above and provided structured survey ratings and feedback from the standpoint of users with medical knowledge and deployment experience
- A review of available literature and Web-based resources on competitive software packages

### 1.3 Results

Results of the study include the following:

- FMSS met nearly all of the claims advertised by the developers associated with creating and maintaining a patient database, generating disease surveillance graphs and reports, and providing current medical references.
- Survey results and user reviews indicated that FMSS was appropriate for use as a surveillance tool for deployed Environmental Health Officers (EHOs) and Preventive Medicine Officers (PMOs).
- Limitations noted for FMSS included potential lack of compatibility with the Medical Data Surveillance System (MDSS) and other medical surveillance tools, mainly related to the exportability of the *International Classification of Diseases*, 9th Revision (ICD-9) codes.
- Other FMSS issues touched on in this study include inconsistencies between the program and the user's manual, lack of flexibility to modify graphs and reports, and unclear error messages.

## **1.4 Conclusions**

FMSS performed satisfactorily in meeting advertised claims. Developers should address users' concerns about inconsistencies between the current version of the program and the user's manual. Most importantly, time series and incidence rate graphs should function as indicated. Another area of concern is the compatibility of FMSS with other medical applications that require the use of ICD-9 codes. It is not clear from the program or the user's manual whether codes are attached to diagnoses made through all available FMSS options. Finally, the addition of other required reports such as disease and nonbattle injury would enhance the usefulness of the program.

## 2.0 Introduction

The Field Medical Technologies program at NHRC is working to optimize and integrate systems for field use at various levels of care, including remote environments. To do so, it is necessary to evaluate how available software might serve this purpose and/or augment existing NHRC products such as MDSS. It is also necessary to provide comparative analyses of systems designed to serve similar functions, such as the Field Medical Surveillance System (FMSS).

## 2.1 Background

FMSS is a product of NHRC and the FMT program that has been fielded for use at the request of a limited number of programs outside NHRC (e.g., Ventura County Health Department, U.S. military Environmental and Preventive Medicine Units ). The developers also have received inquiries about the product from the Federal Emergency Management Agency, the Bureau of Indian Affairs, and the Polish Navy. Informal feedback to developers from these agencies has been positive, but there has been no formal evaluation report on the FMSS product. The present work was conducted by a research team at NHRC separate from the FMSS developer to test the baseline functioning of the product. The developers are presently working on a Windows CE version of basic FMSS functions for use on personal digital assistants (Martin White, personal communication, August 12, 2003).

## 2.2 Objectives

The objectives of this test and evaluation (T&E) study include the following:

- To conduct T&E of FMSS software Version 1.0, provided July 2003, to document a baseline of its functioning relative to the developers' advertised objectives and specific claims
- To provide feedback and recommendations to developers for system improvement for usability and functioning

## 2.3 Description of FMSS

The FMSS user's manual describes FMSS as intended for use at the first echelons of care to help detect emerging health problems that might occur during foreign deployments or conflicts.<sup>1,2</sup> FMSS is intended for installation and use on a laptop computer. It is a medical information and analysis system that incorporates new patient encounters, provider information, and medical reference information.

FMSS is intended for use by Environmental Health Officers (EHOs) and Preventive Medicine Officers (PMOs) during deployments. Its goal is to minimize the impact of disease on deployed forces by providing EHOs and PMOs with timely access to summary and analysis of medical information. The development



of FMSS followed Department of Defense (DoD) requirements for deployment medical surveillance.<sup>3</sup>

The user's manual states that FMSS can help determine incidence rates; project short-term trends; profile the characteristics of affected populations by person, time, or place; track modes of disease transmission; and generate various graphs and reports. FMSS also incorporates the Global Infectious Disease and Epidemiology Network (GIDEON), using an interface specific to military requirements. This is a well-known database for infectious and parasitic diseases from over 205 countries. It is designed to help diagnose most of the world's infectious diseases based on signs, symptoms, and laboratory findings that are entered for patients. FMSS also has a comprehensive list of injuries, noninfectious diseases, and mental illnesses that can be selected without the need for detailed symptomology.

FMSS also provides online medical references such as the Control of Communicable Diseases Manual (CCDM), Tri-Service Reportable Events Guidelines and Case Definitions (TSRE), and select reports from the Armed Forces Medical Intelligence Center's (AFMIC) Medical Environmental Disease Intelligence and Countermeasures (MEDIC) CD-ROM.



### **3.0 Market Research**

A broad review of military medical information systems that may overlap with FMSS functions was conducted to provide a context for the potential applications of FMSS and determine if it has unique functions or technical capabilities.

#### **3.1 SAMS**

The SNAP Automated Medical System (SAMS) is a multi-user administrative management tool. SAMS is in use by more than 1400 sites, including Navy operational commands and Marine Corps medical units, clinics, and medical treatment facilities.<sup>5</sup> SAMS documents and builds reports for medical encounters, environmental health, all-hands medical training, and laboratory results; it also tracks immunizations. SAMS does not include embedded medical training. SAMS was evaluated by MTS Technologies, Inc., during field-testing at Echelon 1 and 2 medical treatment facilities (MTFs) in support of the Cobra Gold 2002 exercise in Thailand. Currently, SAMS is fielded in the Iraq theater and is providing patient encounter information to the MDSS server.

#### **3.2 CHCS**

The Composite Health Care System (CHCS) provides automated medical information support to all MTFs worldwide. CHCS captures data on patient registration, admission, disposition, and transfer; inpatient activity; outpatient administration; appointment scheduling; laboratory drug/laboratory test interaction; quality assurance; radiology; clinical dietetic administration; and pharmacy<sup>6</sup>. The system conducts results reporting and order entry as well as ad hoc reporting. Through CHCS connectivity, users can access other medical facilities and receive specific patient information.

The release of CHCS-II expands the system to include support of general dentistry and optometry. It also includes interface capability with the Defense Enrollment Eligibility Reporting System, the Third Party Outpatient Collection System (TPOCS), and the Pharmacy Data Transaction Service. CHCS utilizes ICD-9 codes in processing data. While FMSS appears to be more mobile and can be used on a network or a stand-alone computer, CHCS is a network-driven program that excels when connected to numerous facilities. Currently, CHCS is integrated with MDSS, providing patient data to be analyzed for detecting and reporting changes in the state of the health of a population.

### 3.3 GEMS

The Global Expeditionary Medical System (GEMS) is currently fielded by the US Air Force. It is made up of three different Internet-based software applications: the Patient Module, the Theater Epidemiology Module, and the Theater Occupational Module. Together, these modules can detect trends in symptoms and diagnosis with military patients and can help physicians determine if troops have been exposed to biological warfare agents.<sup>7</sup> GEMS performs an analysis and graphically displays the deployed force's collective health and readiness. In addition, it records and tracks data to detect illness caused by workplace, military, or natural causes. Its software functions especially well on a laptop or handheld computer that medics can use to record patient information in the field and transmit it for detailed analysis. It incorporates the *Special Operations Medical Handbook*, a field operator's guide, the *Medical NBC Battlebook*, and Mosby RX/TX instructions for the user. The US Government owns the GEMS source code.

### 3.4 SOMDS

The Special Operations Medical Diagnostic System (SOMDS) is a computerized medical diagnostic and treatment system for the support of Special Operations Forces (SOF) medical personnel. SOMDS is designed to be used for the medical assessment, diagnosis, and treatment of patients in remote areas that may be far removed from routine medical facilities. The objective of SOMDS is to enhance the capabilities of SOF medical personnel to assess and manage medical situations and casualties in the field. This objective is realized through the development and implementation of clinical guidelines that bring medical information to the point of need through:

- An embedded expert system that provides a comprehensive medical record and computer-assisted diagnosis and treatment information at the point of need based on evidence-based practice guidelines. An embedded interactive training mode that provides remotely deployed SOF medical personnel with the means to sustain medical proficiency and develop new skills by accessing the expert system and medical references during idle periods.
- An information system that provides teleconsultation and store-and-forward capabilities to remote areas.

### 3.5 MDSS

The Medical Data Surveillance System is a Web-based information system that analyzes ICD-9 codes and allows access to real-time medical threat assessment for deployed forces. The software facilitates response to medical threats by providing the PMO, epidemiologist, or Commander-in-Chief (CINC) Surgeon with automated tools to assist in the process of investigating, identifying, and reporting significant medical events.

MDSS automatically searches patient ICD-9 codes for trends based on epidemiological clues identified by the Centers for Disease Control and Prevention. The system is intended to provide epidemiologists with tools for early detection of disease outbreaks and chemical attacks. It also promises to give medical command and control the ability to integrate patient data from widely dispersed forces for mission planning.

The key feature of MDSS is advanced dynamic change point detection analysis, which is designed to allow early detection of illness trends and disease outbreaks. MDSS analyzes ICD-9 codes using a set of dynamic change point and signal detection algorithms to identify the start and end points of medical events, trends, and shifts within routinely collected data. The system is able to identify incidence spikes using relatively small data sets.

MDSS enables epidemiologists to set and adjust baseline and threshold values, detect shifts and trends within data, and reconstruct the signal to show the form of the underlying event. MDSS automatically alerts medical users of abnormalities and provides tools so that users can investigate the nature and source of medical events. The system can calculate baselines based on a week's worth of data or less from an MTF and provides early warning of trends to alert the medical command of possible disease outbreaks before they become epidemic.

## 4.0 Method

The present study focuses on the validation of the following claims for basic FMSS functions, set forth in the FMSS user's manual:

- Determine incidence rates for disease and injury
- Project short-term trends
- Profile by person, time period, or place
- Track modes of disease transmission
- Generate graphs and reports
- Provide access to medical references

Validation of these claims was conducted via three steps:

- Functionality testing
- A usability review
- A review by technical consultants

### 4.1 Functionality Testing

Two members of the T&E team independently assessed each of these claims during validation testing. Testers prepared a list of 35 functional requirements extracted from the FMSS user's manual. Each function or group of functions was tested and then assigned a pass or fail decision. (Testers were in agreement on all cases except one. In this case, other members of the T&E team provided input to resolve the decision, which will be discussed below.)

### 4.2 Usability Review

Eight members of the T&E team who were experienced with military medical software applications reviewed the functions of FMSS while operating the installed application for a period of approximately 2 to 3 hours. The T&E personnel then completed the Usability Survey (see Appendix B). This survey was originally designed to assess commercial-off-the-shelf products based on current human factors principles.<sup>4</sup> It was adapted for FMSS for the current analyses. The survey uses Likert scale ratings, accompanied by space for brief explanatory comments and elaborations.

### 4.3 Technical Consultant Review

Three technical consultants employed by MTS Technologies, Inc., evaluated FMSS from the standpoint of their experience as military medical personnel in deployed settings. During testing, T&E team members presented the technical consultants with each of the 35 requirements described above and asked them to attempt to complete the specified functions. Then, each technical consultant filled out a brief background survey and the Usability Survey described above, which asked them to rate overall usability and to comment on the strengths and weaknesses of the product. The User Survey is included as Appendix C.

## 5.0 Results

### 5.1 Functionality Testing

Using the FMSS manual, T&E team members generated a list of basic functions to be tested (see Appendix D). These were then used to determine whether FMSS fulfilled its major claims, which were:

- Determine incidence rates for disease and injury
- Project short-term trends
- Profile by person, time period, or place
- Track modes of disease transmission
- Generate graphs and reports
- Provide access to medical references

In order to generate the reports and analyses that fulfill its basic functions, FMSS must be able to create a database. Users tested the ability of the program to allow the creation of a new database or the use of an existing one. FMSS performed to specifications in creating a new unit and new patient demographics and in editing existing ones. Users were also able to generate or edit diagnoses from the various options available: signs and symptoms, disease profiles, area-specific disease data, medical references, clinical studies, and consultations. Then, using the database provided, they tested the functionality claims regarding the generation of reports and analyses.

#### 5.1.1 Incidence Rates for Disease and Injury

Testers were able to select and view the Incidence Rate Text Report. They were not able to create or view a Time Series or Incidence Rate Series graph created from selected dates or diseases, which are listed as options in the user's manual.

#### 5.1.2 Projection of Short-Term Trends

Testers were able to view a trend analysis report. However, this option is not listed or described in the user's guide.

#### 5.1.3 Profile by Person, Time Period, or Place

Testers were in disagreement over whether this option functioned as advertised. Testers were able to generate Surveillance graphs, which profile diseases by variables including agent, dates, and patient demographics. However, the user's manual suggests that the text edit box will allow variables to be selected specifically to be the X or Y axis of the graph, and this was not possible.

### **5.1.4 Track Modes of Disease Transmission**

The Surveillance Graph option allows users to view selected diseases by transmission characteristics. These include reservoir, vector, and vehicle variables. Users were able to select these variables to be graphed.

### **5.1.5 Generate Graphs and Reports**

Testers were able to generate daily logs, patient histories, reportable conditions, classification reports, trend analysis reports, and a text report on incidence rates. Testers were also able to generate Surveillance graphs with the limitations mentioned above (see Section 5.1.3). However, testers were not able to create Time Series or Incidence Rate Series graphs as listed in the user's manual. The rates in the graphs are expressed as "per 100-person days." Most epidemiological reports express rates in terms of patients seen (e.g., number of cases per 1000 patients).

### **5.1.6 Provide Access to Medical References**

Users were able to view the CCDM, MEDIC, and TSRE resources, as described in the user's manual. They were also able to create diagnoses as specified using GIDEON, the ICD-9 disease list, signs and symptoms for diseases by country of disease acquisition, and disease profiles by agent, vector, reservoir, or vehicle. One limitation noted was that the ICD-9 reference did not list diseases and injuries according to their codes.

### **5.1.7 Additional Functions**

During testing, users were able to view and edit the patient database as a spreadsheet. This option is not listed or described in the user's manual. For this reason, the features of this function were not evaluated in detail. However, a preliminary assessment found some potential problems with the spreadsheet (see Appendix E ).

## **5.2 Usability Review**

Eight members of the T&E team used FMSS and its user's manual for a total of approximately 2 to 3 hours. Then, they filled out a survey, which rated FMSS on 15 different aspects related to general usability, including availability and clarity of help, appropriateness of language, and functions for the target user and overall organization. Each item was rated on a 5-point Likert scale where 5 = strongly agree, 1 = strongly disagree, and 3 = undecided. The results of this survey appear in Table 1.

**Table 1. Usability Review Results**

ITEM SUMMARY	MEAN	SD
Uses simple language	4.25	0.46
Language familiar to target user	4.12	0.83
Requires minimal memory load	4.00	0.76
Consistent use of terms and format	3.75	0.71
Provides informative feedback on actions	3.00	0.93
Navigational functions are easy to find	3.37	0.92
Shortcuts available to experienced users	2.62	0.74
Error messages clear and constructive	3.00	0.93
Design minimizes errors	3.62	0.74
Provides help if necessary	2.87	0.83
Graphic design is simple and intuitive	3.75	1.39
Offers flexibility/unwanted steps not necessary	2.62	1.19
Easy to learn basic functions	4.25	0.46
Basic functions are organized reasonably	4.00	0.53
Can undo or redo actions	3.37	1.51

The results of this survey suggest that users were in substantial agreement that FMSS was reasonably easy to learn, targeted appropriately to its user, and well-organized and consistent in the presentation of its basic functions. Users were undecided as to whether the error messages, when they did occur, were useful, and whether help was readily available. Help provided by FMSS was not linked to functions, but the full manual was available for viewing as a pdf document. There were also several inconsistencies between the user's manual and the program itself. The most negative ratings were given in regard to the availability of shortcuts, flexibility, and the necessity of completing unwanted steps. Users specifically mentioned that graphs were not readily modifiable, and that the process of creating a new database did not flow from one step to the next. Several users also commented on the default "blank screen" format. An alternative format presented the patient database as a spreadsheet, but this was not specifically mentioned in the manual (see section 5.1.7).



## 5.3 Technical Consultants Review

### 5.3.1 Survey Ratings

Three technical consultants responded to six survey statements on a Likert-type scale of agreement. Responses were coded from strongly disagree (1) to strongly agree (5). Questions and a summary of responses are as follows:

- *The medical information provided through FMSS was useful ( $M = 3.33$ ,  $SD = 0.58$ ).* The technical consultants indicated that FMSS provided useful information within its limits, but that both the reference material and the reporting options were not comprehensive.
- *The medical information provided through FMSS was easy to use ( $M = 3.00$ ,  $SD = 1.73$ ).* Two participants rated information as easy to use. The remaining technical consultant said that the graphical presentation of the data was confusing, and data presentation options were not sufficiently related to stated Navy medical directives.
- *The medical information FMSS provided was presented in a useful format ( $M = 3.00$ ,  $SD = 1.00$ ).* This rating reflected similar views to the previous question. However, only one technical consultant agreed unequivocally that the format was useful. One was neutral, and the remaining technical consultant reiterated that the presentation of data was confusing.
- *The quality of the medical information provided by FMSS is better than that provided by previous reporting methods ( $M = 2.67$ ,  $SD = 1.53$ ).* Two technical consultants rated FMSS as equal to or better than other electronic methods, and one noted that electronic methods in general have the advantage over paper-and-pencil options. However, the third technical consultant gave FMSS an unfavorable rating compared with the medical information and analytical support provided by MDSS, GEMS, and the Electronic Surveillance System for the Early Notification of Community-based Epidemics (see Section 6.0).
- *FMSS was flexible enough to meet my needs. I could set it up to do what I wanted it to do efficiently ( $M = 2.00$ ,  $SD = 0.00$ ).* Three technical consultants agreed that FMSS did not offer much flexibility in customizing reports. Specific issues mentioned included the lack of an option for a date query in the trend analysis, and limitations on the ability to investigate signs and symptoms.
- *FMSS would help me do my job ( $M = 3.33$ ,  $SD = 0.58$ ).* One technical consultant gave a favorable “overall” rating to this statement. The remaining technical consultants were neutral, with

one citing problems with the design restrictions mentioned in previous items.

### 5.3.2 Open-Ended Items

The remaining six survey items gave technical consultants the opportunity to give open-ended comments in response to questions about FMSS. Their responses are listed below.

*The most useful thing about FMSS for my job would be:*

- Presenting disease trends, alerts, and risks to senior personnel.
- The access to diseases for specific regions.
- Surveillance reports could be helpful once improved and more dynamic.

*The least useful thing about FMSS for my job was:*

- N/A. All aspects were applicable.
- Stand-alone program that needs to be incorporated into one standard system for medical. May duplicate workload as it stands now.
- Having to enter data.

*If I could add one thing to FMSS, it would be:*

- I would add a design option using contributions or recommendations of end users and not superiors, higher-ups, or personnel not directly involved or well-experienced in subject matter.
- Additional information from the Merck Manual.
- Data query analysis.

*What features of FMSS did you like?*

- Graphs and tables.
- Disease access to specific regions.
- Surveillance comparisons. Would like to see it compare or analyze more than two fields.

*What features of FMSS did you dislike?*

- Very little. Recommend proofreading of verification of terms, syntax, verbiage, etc., in relation to specific subjects, i.e., mammals: man, horse, goat, deer, pig, dog, etc.
- Can only open one form at a time. Data would have to be entered after patient was seen since you cannot print specific medical encounters.
- General graphs.

*Where would you consider FMSS a best fit in the military medical arena?*

- In the upper echelon preventive medicine area.
- As the system is now, it would fit into a preventive medicine unit. With additional features such as standard medical forms, it could be used in any operational medical unit.
- Military is looking for programs with minimal user interface regarding medical data. In FMSS, you must transcribe medical info from treatment records. FMSS may be useful in lower echelon MTFs for local trend analysis.

## **6.0 Conclusions**

### **6.1 Functional Claims by Developer**

The results indicate that the FMSS application Version 1.0 generally worked as advertised by the developers. The product executed the basic functions of receiving patient information directly from providers; determining incidence rates; generating trend analysis reports; profiling by person, time, or place; tracking modes of disease transmission; generating graphs and reports; and providing access to medical references. See Section 5.0 and Appendix D for a complete account of functions and specific comments on their performance.

### **6.2 Usability and Review by Technical Consultants**

The program was easy to use and could be learned rapidly by new users. The usability and reviews by technical consultants indicated that the main area of concern was in access help to support user questions or correct user mistakes. However, there were several cases in which functions were not listed in the user's manual or were described in the user's manual in a way that was inconsistent with their actual operation. See Section 5.0 for specific examples.

### **6.3 Compatibility With Code 23 Program Architecture**

FMSS Version 1.0 does not appear to meet program requirements in that it does not collect a complete set of information on ICD-9 codes linked to any input of patient information. Also, it appears that FMSS Version 1.0 does not have the capability to export its patient database with ICD-9 codes to other applications. This is important if the medical records are to be downloaded and analyzed by other applications, such as MDSS or the Joint Medical Work Station (JMeWS). FMSS overlapped with MDSS extensively but lacked certain reports such as disease and nonbattle injury (DNBI) and provided less capability than MDSS for analyzing trends for disease outbreaks. FMSS did provide some decision aid information and medical reference material that is not found in MDSS.

### **6.4 Stand-Alone Capability**

This review indicates that FMSS could function by itself to support preventive medicine units in the field. FMSS generates systematic records of patient diagnosis and treatment, as well as surveillance of disease trends. The system also provides decision support for diagnosis, given provider location in remote locations.

Further field testing will be needed to validate provider use of this application as a stand-alone medical support system. The technical consultants in this study suggested that FMSS had the potential to support field medical care, but two of the three were unsure it would help them do their jobs as designed and given current medical business practice.

There was also concern that FMSS was limited in surveillance capabilities compared with systems such as GEMS and MDSS. However, FMSS appears to be more useful for preventive medicine officers or Corpsmen for local support of smaller units in remote locations, rather than the service-wide surveillance for which MDSS appears to be targeted. Providers can input patient data directly into FMSS, and MDSS does not have this capability. In contrast to MDSS, FMSS requires only a portable laptop system; such a system might be suitable for many forward levels of care, such as small surface ships and some field medical units supporting far-forward combat.

## 7.0 Recommendations

The present data suggest this system has substantial potential and would benefit from field evaluations. The developers might follow up to request formal feedback from current users in the field to support decisions on how to field this system in the future. Other recommendations include the following:

- The capability of FMSS to import and export ICD-9 codes needs to be fully tested. This would allow system integration with other applications used at various levels of care. This is not addressed in the user's manual or the developers' advertised claims. In order for FMSS to be compatible with other medical surveillance systems such as MDSS, a systematic set of ICD-9 codes is required, and they should be exportable as files to other applications such as JMeWS or MDSS. Similarly, compatibility may also require that diagnoses reached via other options in FMSS (e.g., through GIDEON or by signs and symptoms) be categorized by ICD-9 code.
- One technical consultant recommended that the Merck Manual be added as a reference.
- Either the program or the user's manual should be changed so that the Surveillance Graph functions as described, and a section on the Spreadsheet View and its features should be included.
- One technical consultant suggested that it would be useful to be able to examine outcomes by more than two variables.
- Some specific attention to access to help functions would increase usability of this product. The user's manual should be updated to be consistent with all application functions. For instance, time series reports are described in the user's manual but do not appear functional in the current application.
- The graphics functions could be enhanced to allow flexibility for users to analyze information. Options to express surveillance information as rates should be flexible and consistent with epidemiological/military standards.
- Some additional required surveillance reports such as DNBI could be added to this application. The developers also need to include the time series and incidence rate graph capability described as an option by the user's manual.



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**Appendix A**  
**Readiness Assessment Form**

## Readiness Assessment

### PRODUCT INFORMATION

**Product:** FMSS

**Developer:** NHRC, Code 23: Martin White PI

**Cost:** \$ Not Determined

#### Installation/Support

**Software:** Application/Manual on CD

**Documentation:** Tech Report "A Field Medical Surveillance System for Deployed Forces"

**Training:** None – only user's manual

**Specifications:** Windows NT 4.0 or 2000/MS Access on laptop computer  
64 MB RAM

#### CLAIMS

**Functional:** See functional claims on right.

**Technical:** See technical claims on right.

### EVALUATION

#### FUNCTIONAL

##### Claim

Determines disease incidence rates/trends

Tracks modes of disease transmission

Profiles patient by person, time period, or place

##### Requirement

DoD medical surveillance

DoD medical surveillance

Electronic medical patient encounter module

##### Observed

Determined Incidence rates

Generated trend analysis reports

Tracked modes of disease transmission

Profiled patient by time period or place

#### TECHNICAL

##### Claim

Medical reference

Generate graphs and reports

Provide access to medical references

##### Requirement

Medical reference and decision support for field Epidemiological analysis tools

Medical decision aids

##### Observed

Incorporated GIDEON database

Graphics functional with some limitations

Multiple medical guides available

#### Compatibility With Program Architecture:

Not satisfactory for data transfer to JMeWS/MDSS without complete set of exportable ICD-9 codes.

### Requirements

**Functional:** surveillance, medical record, medical reference.

**Technical:** See technical claims on right.

### Rating

**Functional:** Satisfactory for use in field by PMOs and Corpsmen with laptop computer.

**Technical:** Not satisfactory for integration: ICD-9 codes must be complete and exportable. Help functions and graphics could be improved.

**Overall:** Satisfactory as stand-alone tool for field use.  
Not satisfactory for integration with other applications without ICD-9 exporting capability.

## **Appendix B**

### **Usability Survey**

**Instructions:**

A) Rate each statement below as 1–5 for agreement.

(1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree.)

B) If you have any comments, write them in the space provided. Please include any suggestions you have and any examples that support your rating.

1) Uses simple language. \_\_\_\_\_

\_\_\_\_\_

2) Language is familiar to target user. \_\_\_\_\_

\_\_\_\_\_

3) Use requires minimal memory load. \_\_\_\_\_

\_\_\_\_\_

4) Consistent use of key terms and format for navigation. \_\_\_\_\_

\_\_\_\_\_

5) Feedback: System provides informative feedback to user on actions performed. \_\_\_\_\_

\_\_\_\_\_

6) Navigational functions are easy to find on every screen. \_\_\_\_\_

\_\_\_\_\_

7) Shortcuts are available for experienced or expert users but are not necessary. (Accessibility to varied user expertise.) \_\_\_\_\_

\_\_\_\_\_

8) Error messages are clear and provide constructive solutions. \_\_\_\_\_

\_\_\_\_\_

9) Design is built to prevent or minimize user error (forgiveness). \_\_\_\_\_

\_\_\_\_\_

10) Provides help if necessary. \_\_\_\_\_

\_\_\_\_\_

11) Aesthetics: Graphic design is simple and intuitive. \_\_\_\_\_

---

12) Flexibility: User can do what they want when they want.  
User doesn't have to go through unwanted steps every time. \_\_\_\_\_

---

13) Easy to learn to use. User can understand basic functions within an hour. \_\_\_\_\_

---

14) Basic functions are grouped/organized in a reasonable fashion. \_\_\_\_\_

---

15) User can undo or redo actions. \_\_\_\_\_

---

## **Appendix C**

### **FMSS User Survey**



**Your Name** \_\_\_\_\_

**Phone** \_\_\_\_\_ **E-mail address** \_\_\_\_\_

**Date** \_\_\_\_\_

**Gender:** \_\_\_\_\_ Male \_\_\_\_\_ Female

**Active Duty:** \_\_\_\_\_ Yes \_\_\_\_\_ No

**Service:**

\_\_\_\_\_ Navy  
\_\_\_\_\_ Army  
\_\_\_\_\_ Air Force  
\_\_\_\_\_ Marines  
\_\_\_\_\_

**What was your position title?**

\_\_\_\_\_ GMO (General Medical Officer)  
\_\_\_\_\_ PMO (Preventive Medicine Officer)  
\_\_\_\_\_ EHO (Environmental Health Officer)  
\_\_\_\_\_ IDC (Independent Duty Corpsman)  
\_\_\_\_\_ Nurse  
\_\_\_\_\_ Physician's Assistant  
\_\_\_\_\_ Command Surgeon  
\_\_\_\_\_ Task Force Surgeon  
\_\_\_\_\_ CINC Surgeon  
\_\_\_\_\_ Epidemiologist  
\_\_\_\_\_ Task Force Commander  
\_\_\_\_\_ HAZMAT  
\_\_\_\_\_ Other \_\_\_\_\_

**Which area best describes your education and/or training? (Choose one.)**

\_\_\_\_\_ Statistics  
\_\_\_\_\_ Epidemiology  
\_\_\_\_\_ Preventive Medicine  
\_\_\_\_\_ Other \_\_\_\_\_

**How much experience did you have with medical data software? (months/years)**

\_\_\_\_\_

**How much experience did you have working aboard a deployed ship? (months/years)**

\_\_\_\_\_

**Your written comments will assist in the development of this technology for the medical support of the armed forces. Please provide them wherever possible, even if it's just a few key words.**

**FMSS Information**

1. The medical information provided through FMSS was useful.

☐ Strongly Agree   ☐ Agree   ☐ Neither Agree Nor Disagree   ☐ Disagree   ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. The medical information provided through FMSS was easy to use.

☐ Strongly Agree   ☐ Agree   ☐ Neither Agree Nor Disagree   ☐ Disagree   ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. The medical information FMSS provided was presented in a useful format.

☐ Strongly Agree   ☐ Agree   ☐ Neither Agree Nor Disagree   ☐ Disagree   ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. The quality of the medical information provided by FMSS is better than that provided by previous reporting methods. (Please specify reporting methods previously used.)

☐ Strongly Agree   ☐ Agree   ☐ Neither Agree Nor Disagree   ☐ Disagree   ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. The FMSS system was flexible enough to meet my needs. I could set it up to do what I wanted it to do efficiently.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. FMSS would help me do my job.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree  
☐ Not Observed

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. The most useful thing about FMSS for my job would be \_\_\_\_\_  
\_\_\_\_\_

8. The least useful thing about FMSS for my job was \_\_\_\_\_  
\_\_\_\_\_

9. If I could add one thing to FMSS it would be \_\_\_\_\_  
\_\_\_\_\_

10. What features of FMSS did you like?

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. What features of FMSS did you dislike?

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

12. Where would you consider FMSS a best fit in the military medical arena?

Please Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## **Appendix D**

### **Functionality Survey**

FMSS TEST LOG				
PROJECT ID: Field Medical Surveillance System				
DATE: July 2003		DEVELOPER/TEST ENGINEER:		
PROGRAM/MODULE: Field Medical Surveillance System				
TEST CASE ID	TEST CONDITIONS	TEST RESULTS PASS/FAIL	COMMENTS	PROBLEMS ENCOUNTERED
FMSS – FO1		pass	User was able to create a new database or open an existing database without difficulty.	
FMSS – FO2		pass	User was able to verify existing units or unit and was able to record basic demographics for each patient without difficulty.	
FMSS – FO3		pass	User was able to enter diagnosis/treatments and edit diagnosis for each patient without difficulty.	Page 13 of the user’s manual displays a screen shot of the FMSS software. The screen shot displays a Provider drop-down box under the tab titled Diagnosis; however, the software displays a Visit drop-down list. Page 14 of the user’s manual states that the software “also allows you to select a provider (Corpsman, Doctor, Specialist, or Other).” Recommend changing the user’s manual to reflect actual software screens. The Provider drop-down list displays when the tabs titled Consultations, Clinical Studies, and Treatments are chosen.
FMSS – FO4		pass	User was able to query the database to view the different reports and graphs.	Trend Analysis is not listed in the user’s manual but is offered as a report.

FMSS – FO5		pass	User was able to access and view/review resource/reference manuals.	
FMSS – FO6		pass	User was able to access the online help.	The online help feature “About GIDEON” and “About AFMIC/MEDIC” displays a window but this window cannot be closed using the typical close function seen upper right marked X; it appears to be disabled. A user has to close the feature by clicking on the display. This is not intuitive.
FMSS – FO7		pass	User was able to open an existing database with ease from either the main screen or the File menu.	Documentation in the user’s manual is inconsistent with the actual screen. Page 5 of the user’s manual states that you can open an existing database either at the opening screen or from the File menu. The user’s manual states, “when you first open FMSS, a screen will appear asking if you want to open an existing database.” However, the installed system does not provide an opening screen; instead, the system opens to the last database that was viewed. This was found on both a client and stand-alone system.
FMSS – FO8		pass	User was able to create a new unit from the File menu with ease.	
FMSS – FO9		pass	User was able to open/review reports from the Reports menu.	
FMSS – FO10		fail	User was able to create a new demographic after resolving one problem.	FMSS will allow a user to type in a social security number with 10 digits, but will not properly space the digits if they are typed too quickly.
FMSS – FO11		pass	User was able to edit a demographic.	When editing patient demographics, if a date within the date of birth is a single-digit number, the system will prompt the user to re-check and re-enter the DOB to match the format. When the file was created, the system would not allow the incorrect date format to be entered, so FMSS is changing the format

				<b>requirements somewhere in the system.</b>
--	--	--	--	--

FMSS – FO12		pass	User was able to delete a demographic.	
FMSS – FO13		pass	User was able to add a diagnosis.	
FMSS – FO14		pass	User was able to use the new Diagnosis box to select a provider and enter consultations.	
FMSS – FO15		pass	User was able to enter a diagnosis for a patient or patients.	
FMSS – FO16		pass	User was able to enter a diagnosis for a patient or patients from signs and symptoms.	
FMSS – FO17		pass	User was able to profile the differential list of diseases.	
FMSS – FO18		pass	User was successful at reviewing information on epidemiological data.	
FMSS – FO19		pass	User was successful viewing what countries the disease is known in.	
FMSS – FO20		pass	User was successful in selecting diagnosis using the disease profiles.	
FMSS – FO21		pass	User was successful in selecting a diagnosis using GIDEON.	
FMSS – FO22		pass	User was successful in selecting and entering consultations on patients or patient.	



FMSS – FO23		pass	User was successful in selecting and entering clinical studies.	
FMSS – FO24		pass	User was successful in selecting and entering treatments.	
FMSS – FO25		pass	User was successful in selecting and entering duty status on patients or patient.	
FMSS – FO26		pass	User was successful in selecting and entering diagnosis on patients or patient.	
FMSS – FO27		pass	User was successful in selecting and deleting diagnosis on patients or patient.	
FMSS – FO28		pass	User was able to view/print the daily log for a selected day.	
FMSS – FO29		pass	User was able to view/print a patient's history.	
FMSS – FO30		pass	User was able to view/print the reportable conditions.	
FMSS – FO31		pass	User was able to view/print the Classification Report.	

FMSS – FO32		fail	User was not able to report on unit(s) patient variables to one or more diseases based on the number of cases or the incident rate.	<b>User was unable to create or view a Time Series or an Incidence Rate Series Graph. There was no option to do so, even though it is listed in the user's manual. The user can pull up a text report, but no graphs are available.</b>
FMSS – FO33		pass	User was able to graph unit(s) patient variables to one or more diseases based upon the number of cases or the incident rate.	<b>There is no option to specifically choose X and Y axis. This action is not user-friendly. Recommendation would be to identify the X and Y axis in the Text Edit box identifying the X and Y axis of the selected variable. Also, if the Y-axis is removed, it should not automatically move to the X-axis position.</b>
FMSS – FO34		pass	User was able to access/view the online resource/reference manuals.	
FMSS – FO35		pass	User was successful in selecting and viewing the trend analysis report.	Not listed in user's manual.

**Appendix E**  
**Problem Reports for FMSS Spreadsheet View**

## **Problem Description #1**

In the Spreadsheet View, the user is able to modify data cells and save changes to Unit, Demographic, and Encounter data. Changes made in this way may not be reflected when the data are viewed through other features. For example, changing and saving an entry under Race in the spreadsheet cell did not result in a change when the same patient's record was viewed through the Edit Demographics menu.

### **How to Repeat**

In Spreadsheet View (under the File menu), click on any cell in any of the three spreadsheets. Edit the data within the cell and click on any cell in the next row up or down. Click OK. The change will appear when the spreadsheet view is recalled, but will not appear when the patient data are requested through the Unit, Demographic, or Encounter Edit menus.

## **Problem Description #2**

FMSS allows the user to create and define new units within a database. When a new unit was created and viewed under Spreadsheet View, the Encounters page of the spreadsheet contained a list of encounters, even though no data for any patients had been entered. The listed encounters could not be accessed for editing or deletion. This problem only appears in the Middle East.fpd file, and appears to be a database bug.

### **How to Repeat**

Open the Middle East.fpd database through Open Database under the File menu. Select Create Unit from the File menu and create a unit using any data. Select Spreadsheet View from the File menu and select the newly created unit from the Unit spreadsheet. The Demographics spreadsheet will be empty, but the Encounter spreadsheet will have several entries in it. The New and Edit buttons on this spreadsheet are inactive.

## **Appendix F**

### **Acronyms**

## Acronyms

AFMIC	Armed Forces Medical Intelligence Center
CCDM	Control of Communicable Diseases Manual
CHCS	Composite Health Care System
CINC	Commander-in-Chief
DNBI	Disease and Nonbattle Injury
DOD	Department of Defense
EHO	Environmental Health Officer
FMSS	Field Medical Surveillance System
FMT	Field Medical Technologies
GEMS	Global Expeditionary Medical System
GIDEON	Global Infectious Disease and Epidemiology Network
ICD-9	International Classification of Diseases, 9th Revision
JMeWS	Joint Medical Workstation
MDSS	Medical Data Surveillance System
MEDIC	Medical Environmental Disease Intelligence and Countermeasures
MTF	Medical Treatment Facility
NHRC	Naval Health Research Center
PMO	Preventive Medicine Officer
SAMS	SNAP Automated Medical System
SOF	Special Operations Forces
SOMDS	Special Operations Medical Diagnostic System
T&E	Test and Evaluation
TSRE	Tri-Service Reportable Events Guidelines and Case Definitions

## REPORT DOCUMENTATION PAGE

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1. Report Date (DD MM YY)  
10 September 2003

2. Report Type  
Technical Document

3. DATES COVERED (from - to)  
July 2003 to September 2003

4. TITLE AND SUBTITLE  
Test and Evaluation Report for the Field Medical Surveillance System (FMSS)

6. AUTHORS  
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  
Naval Health Research Center  
P.O. Box 85122  
San Diego, CA 92186-5122

8. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)  
Commanding Officer Commander  
Naval Medical Research Center Navy Medical Support Command  
503 Robert Grant Ave PO Box 240  
Silver Spring, MD 20910-7500 Jacksonville, FL 332212 0140

5a. Contract Number:  
5b. Grant Number:  
5c. Program Element: 03729  
5d. Project Number: 09162  
5e. Task Number:  
5f. Work Unit Number: 60330

9. PERFORMING ORGANIZATION REPORT NUMBER  
Report No. or Tech Doc No. 06-2B

10. Sponsor/Monitor's Acronyms(s)  
NMRC/NMSC

11. Sponsor/Monitor's Report Number(s)

12 DISTRIBUTION/AVAILABILITY STATEMENT  
Approved for public release; distribution is unlimited.

### 13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words)  
A brief (approximately 200 words) factual *summary* of the most significant information.

This report represents a test and evaluation of the Field Medical Surveillance System (FMSS), a product of the Field Medical Technologies program of the Naval Health Research Center (NHRC). The FMSS is a medical information and analysis system that incorporates new patient encounters, provider information, and medical reference information. Its goal is to minimize the impact of disease on deployed forces by providing access to medical summary and evaluation information.

FMSS met nearly all of the claims advertised by the developers associated with creating and maintaining a patient database, generating disease surveillance graphs and reports, and providing current medical references. Survey results and user reviews indicated that FMSS was appropriate for use as a surveillance tool for deployed Environmental Health Officers and Preventive Medicine Officers.

Developers should address inconsistencies between the program and the user's manual. Most importantly, time series and incidence rate graphs should function as indicated. Another concern is the compatibility of FMSS with other medical applications using ICD-9 codes. It is not clear whether codes are attached to diagnoses made through all available FMSS options. Finally, the addition of other required reports such as disease and nonbattle injury would be useful.

15. SUBJECT TERMS  
medical surveillance, epidemiology

### 16. SECURITY CLASSIFICATION OF:

a. REPORT UNCL  
b. ABSTRACT UNCL  
b. THIS PAGE UNCL

17. LIMITATION OF ABSTRACT  
UNCL

18. NUMBER OF PAGES  
X

19a. NAME OF RESPONSIBLE PERSON  
Commanding Officer

19b. TELEPHONE NUMBER (INCLUDING AREA CODE)  
COMM/DSN: (619) 553-8429